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ABSTRACT

The potential usefulness of C. Perrow's (1967) social-technical approach to describing elementary schools is described. This approach is based on the organizational technology and proposed relationships among social, structural, and personnel dimensions of organizations. Perrow's formulation of technology contains two dimensions: (1) analyzability--the number of exceptional cases encountered and the nature of the search process in dealing with them; and (2) variability--the variability of the raw materials and the extent to which the materials can be handled in a standardized manner. Patterns of relationships with technologies include two structural variables: (1) coordination; and (2) influence. Regular full-time elementary school teachers (n=272) in 23 northern Alabama schools completed questionnaires classifying their schools by patterns of variability and analyzability. When schools were grouped by technology, four levels became apparent. Evidence indicates that the complexity that is associated with job involvement, motivation, meaningfulness of work, and satisfaction was limited to task variability and not strongly associated with cognitive complexity. Three figures conclude the document. (SLD)

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Social-Technical Theory and Elementary Schools

An Exploratory Study

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Running head: SOCIAL-TECHNICAL THEORY

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Abstract

This paper explores the potential usefulness of Perrow's (1967) social-technical approach to describing/diagnosing schools which is based on the nature of organizational technology and proposed relationships among social, structural, and personnel dimensions of organizations. Perrow's model is based on a broad definition of technology that involves the actions that an individual performs upon an object, with or without the aid of tools or mechanical devices, in order to make some change in that object. The object, or 'raw material' may be a living being, a symbol, or an inanimate object, more specifically the work done on raw materials. Essentially the nature of raw materials determines the technology to be used.

Perrow's formulation of technology contains two dimensions: (1) analyzability; the number of exceptional cases encountered and the nature of the search process in dealing with the exceptional cases and (2) variability; the stability or variability of raw materials and the extent to which the materials can be handled in a standardized fashion. These two technology dimensions and their accompanying raw material descriptions are illustrated in Figure 1.

This system allows one to divide organizations into four types based on their technology and allows for making predictions regarding structural, process and personnel variables. At the most general level Perrow proposes that "the variations within

one type of organization may be such that some schools are like prisons, some prisons like churches, some churches like factories and some factories like universities, and so on" (p. 204). For present purposes the concern is limited to the internal dimension of schools as units including technology, structure (coordination and influence), and the collective characteristics of personnel at the school level.

Perrow proposed patterns of relationships with technologies which included two structural variables: coordination and influence. The relation between technology and coordination is a generally accepted idea. (See Hage & Aiken, 1969 and Hall, Hass & Johnson 1967) The general expectation is that more complex technologies (tasks) will lead to more complex interaction and increased coordination among personnel at the operational level. Meyer & Rowan (1983) suggest that this relationship is also true for schools although they arrived at the hypothesis using a slightly different rationale. They reason that because the formal structure of schools is separated from the technical core operation, the internal operation is left to the discretion of teachers who then determine the social and structural processes informally.

Furthermore, Scott (1987) suggests that technical complexity may give rise to greater complexity of the performer rather than complexity of structure. The use of professionals, the typical complexity performer, is appropriate when (1) the work is

uncertain and (2) the work does not involve high levels of interdependence among workers. Thus, coordination may be replaced by the expertise of the autonomous professional.

Influence, a second structural variable, is the degree of discretion personnel have in the conduct of the production process. In non-routine types of organizations which are characterized by complex search processes and the need to deal with many exceptions, influence is expected to be high. This degree of influence is probably high because professional staff are faced with operational decisions in a system that functions best through feedback rather than through advanced planning and regulating.

The social-technical approach also proposes interrelations among technology and the attributes of those who perform the work in organizations. In a study which employed the technological classification scheme of Thompson (1967) the technical processes characterizing production units were found to be highly related to employee satisfaction and motivation (Rousseau 1978). One conclusion of this study was that employees in highly routinized units reported lower satisfaction and motivation than employees in units with technologies allowing greater discretion and problem solving. These relationships are widely accepted and confirmed in a variety of organizational settings at the individual as well as unit level of analysis (McDaniel, Schmidt, and Hunter, 1988, Brooks, Russell and Price, 1988, Gerhart 1988).

The general interpretation is that employees tend to be more satisfied with more complex jobs.

The purpose of this study was to determine the potential usefulness of Perrow's social-technical approach in describing elementary schools. This was accomplished by classifying schools based on the two technology factors and then examining patterns of structural and personnel variables among technological categories.

Methods

Subjects

All regular full-time teachers in 23 North Alabama schools participated in the study. The sample included all elementary teachers in three school districts. The districts included the four elementary schools in a small city district, nine elementary schools in a larger city district and ten elementary schools in a rural county district. Altogether 272 teachers completed questionnaires.

Instruments

School technology was measured by the School Task Scale (Keckley 1981) an instrument developed to operationalize Perrow's model for schools. The dimensions measured are (1) variability of task; the stability and variability of raw materials (students and events) and the extent to which materials can be handled in a

standardized fashion, and (2) analyzability; the number of exceptional cases encountered and the complexity of the cognitive search process used in dealing with exceptional cases. This combination of technology, based on the demands made by raw materials, and the accompanying search process involved, provides for classification of schools.

The organizational structure variables coordination and influence were measured by scales developed by Cohen, Deal, Meyer, and Scott (1976). Here coordination is limited to the informal techniques used by teachers to facilitate their management of the teaching-learning process. Indicators of coordination were based on teachers' responses to a series of questions about their informal communication concerning teaching methods, instructional materials, lesson content, managing students, evaluating students and scheduling instruction. The influence measure utilizes teacher perceptions of their influence in the same instructional areas.

Teacher attribute measures were: meaningfulness of work: the individual's perception of the personal value of his work, along with the strength and continuation of commitment to a kind of job as a dimension of his personal identity (Hackman & Oldham 1974); intrinsic motivation: the degree to which a job holder is motivated to perform well and the feeling of accomplishment because of the subject rewards from work (Lawler & Hall 1970); job involvement: the degree to which an individual is

psychologically identified with his work (Ladahl & Kejner 1965), and satisfaction, the degree to which an individual's job actually provides growth experiences he feels it should (Lawler & Hall 1970). Validation of these measures for use with teachers is reported by Keckley (1983).

Procedures

All questionnaires were distributed to teachers at their schools. Teacher responses were aggregated to provide a standardized school mean on each technology variable. School means were then plotted analyzability against variability thereby creating four categories of school. Six schools appeared in cell 1, four schools in cell 2, six schools in cell 3, and seven schools in cell 4. Analysis of variance and chi square statistics were used to examine this distribution of schools among cells.

In order to identify patterns of structure and teacher attributes, the mean for schools in each technology cell were calculated and used to rank the variable by cell: Non-parametric statistics were used to examine the patterns of ranking of these variables.

Results

Classifying schools based on variability and analyzability resulted in the assignment of six schools in cell 1, four schools in cell 2, six schools in cell 3 and seven schools in cell 4. The chi square test indicated that this distribution of schools is not significantly different from that expected. Analysis of variance procedures identified cell 1 as significantly different from cell 3 and 4 on variability and cell 2 was different from cell 3 and 4 on analyzability. The zero order correlation of analyzability and with variability scores showed a moderate inverse relationship ($r=-.30$).

The ranking by cell of coordination and influence are presented in Figure 2. Coordination is ranked first in cell 3 where high variability and low analyzability are common, and last in cell 2 where variability is perceived to be high and the search process is complex. Influence was ranked highest among schools that were characterized as most structured, cell 1. These rankings correspond roughly to the correlation between the coordination and influence ($r=.40$).

Figure 3 displays the result of the ranking of teacher attributes by cell. A clear pattern of agreement among cell ranking of variables was evident and was confirmed using Kendall's coefficient of concordance ($W = .78$, $p< .03$). The staff of schools in cell 4 have the lowest levels of perceived

meaningfulness of work, motivation and job satisfaction. Schools in cell 3 have the highest levels of these variables as well as high levels of job involvement. Cell 1 and 2 schools were characterized as having moderate levels of each teacher variable.

Discussion

The study illustrates some of the possible uses of a social-technical approach to describing schools. When schools are classified based on Perrow's dimensions of task variability and task analyzability some interesting, perhaps promising, observations and patterns among variables are possible. One can fairly well confirm that schools have unique structural and staff characteristics and the differences among schools are due at least in part to differences in teachers' perceptions of the technology employed. It should not however be concluded that this study supports a simple technological determinism.

It is interesting to note that only when schools are grouped by technology do differences appear. Schools are not significantly different in their task perceptions using ungrouped data, nor are there differences among school districts based on analyzability and variability. The lack of schools appearing at the extremes, cells 2 and 4, indicates that elementary schools are not as structured as continuous processing organizations or custodial schools. Neither do schools appear at the highly

professional extreme. It thus would appear that the on-going debate about the nature of teaching is better described as routine versus craft than routine versus professional.

With regard to structural variables (coordination and influence exercised by teachers) we find mixed results. The findings should not be thought of as a test of Perrow's propositions regarding coordination and influence in that he was concerned with the lower level supervisors in production units. It is possible, however, to view teachers similarly based on the assertion that in the absence of first-line supervisors in schools teachers assume the responsibility for coordinating instruction at the operational level. The rankings of coordination and influence seem to be associated with neither technology factor. Looking only at the extremes, coordination is greatest in schools with higher variability but not in those with cognitively complex technologies. The low level of coordination in the least routine schools (cell 2) may support Scott's proposition that the complexity of the individual performer is replacing the structural complexity usually achieved through coordination. This conclusion is certainly questionable when the level of teachers job involvement, motivation, and satisfaction are considered. One would expect high levels of these attributes to be consistent with coordination if these staff members are to be considered professional (see Etzioni, 1961). It could also be argued that the high level of cognitive complexity in schools in cell 2 is simply too demanding.

The most striking result of ranking teacher attributes by technology is their association with task variability. The finding that variability of task is associated most clearly with teacher attributes is consistent with the recommendation from job design studies which suggest that employees respond better in more complex job situations. These findings generally confirm findings in studies of other types of organizations with regard to employee attributes.

In a parallel study of school task, variability accounted for 55% of the variance in motivation. Also the same study found a significant canonical correlation (.60) between sets of task variables and sets of individual variables (Keckley, 1988).

The present evidence indicates that the complexity that is associated with job involvement, motivation, meaningfulness of work, and satisfaction is limited to task variability and is not strongly associated with cognitive complexity.

It seems reasonable then from this and other exploratory studies that useful patterns of association among technology and structure and technology and teacher attitudes can be identified to assist in describing and distinguishing among schools. It does seem reasonable then to continue the process of adapting the available knowledge of organizations for use with schools. The need for theory guided descriptions of schools as organizations remains compelling.

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Figure 1. Technology and Raw Material Variables

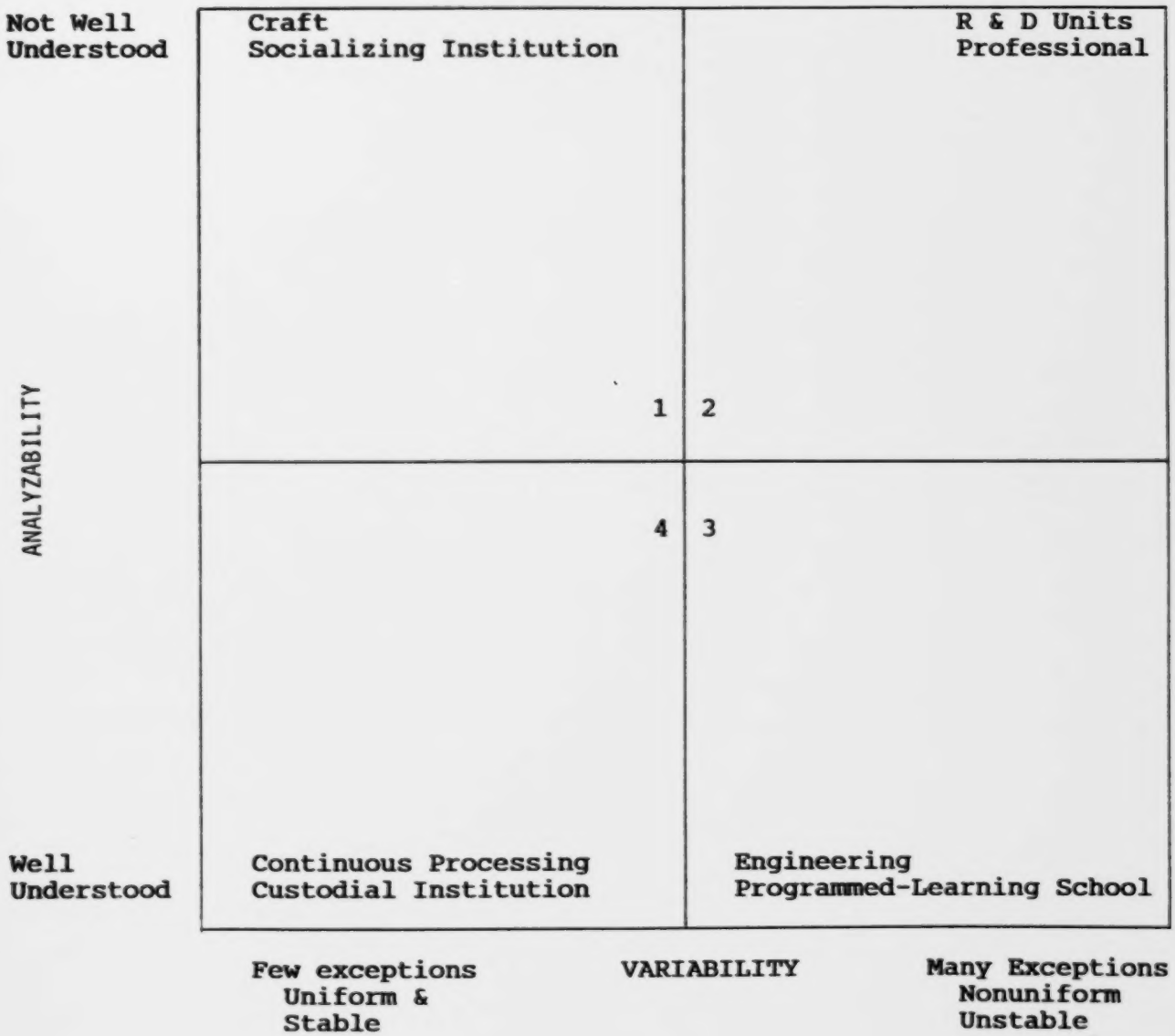

FIGURE 2. Rank of Coordination and Influence by Technology Category

Not Well Understood		
	Craft **Socializing Institution** **Variable** — **Rank** Coordination — 2 Influence — 4 1	**R & D Units** **Professional** **Variable** — **Rank** Coordination — 4 Influence — 3 2
	4 **Variable** — **Rank** Coordination — 3 Influence — 1 **Continuous Processing** **Custodial Institution**	3 **Variable** — **Rank** Coordination — 1 Influence — 2 **Engineering** **Programmed Learning School**
Well Understood		

ANALYZABILITY

Few exceptions
Uniform &
Stable

VARIABILITY

Many Exceptions
Nonuniform &
Unstable

FIGURE 3. Rank of Teacher Attributes by Technology Category

Not Well Understood

ANALYZABILITY

Craft Socializing Institution		R & D Units Professional	
Variable	Rank	Variable	Rank
Meaningfulness	3	Meaningfulness	2
Motivation	3	Motivation	2
Job Involvement	2	Job Involvement	4
Satisfaction	2	Satisfaction	3
	1		2
	4		3
Variable	Rank	Variable	Rank
Meaningfulness	4	Meaningfulness	1
Motivation	4	Motivation	1
Job Involvement	3	Job Involvement	1
Satisfaction	4	Satisfaction	1
Continuous Processing Custodial Institution		Engineering Programmed Learning School	

Well Understood

Few exceptions Uniform & Stable — VARIABILITY — Many Exceptions Nonuniform & Unstable